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A PITH-MINER IN BISCUIT-ROOT

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Forest Insect Research (Insect identification)

Enclosed is an office report concerning a fly inhabiting biscuit-root stems. Identification of this fly as a new species was recently made by Mr. G. C. Steyskal, and we thought the story connected with its disclosure would be of interest to him. The fly appears to be of no economic significance. However, the biological information might be of some value when the species is described, and might be worth a scientific note.

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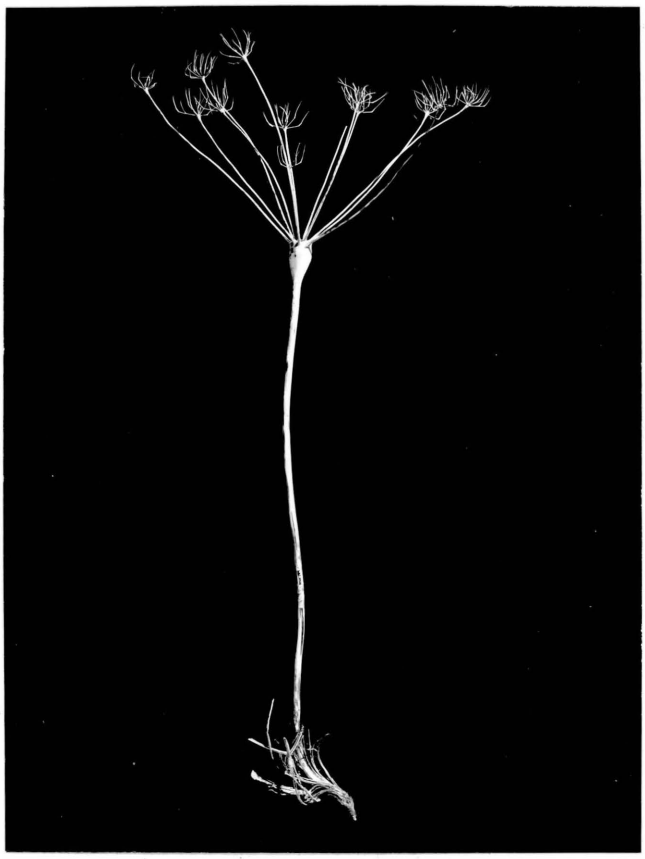

Figure 1. Biscuit-root plant in dead and withered condition in late summer and fall. (PS-3207)

A PITH-MINER IN BISCUIT-ROOT

Biscuit-root or barestem lomatium (Lomatium nudicaule (Pursh) C. & R.) occurs throughout the Pacific Northwest and is a common range plant in the Blue Mountains of eastern Oregon and Washington. It is usually found growing in rocky soil on dry upland slopes and ridges.

The roots of various species of biscuit-root were used as food by the Indians; the "Diggers" dwelling along the Snake River were literally dependent upon these plants for survival.[1/] Because of its early growth and maturity, biscuit root is valuable as forage on ranges grazed by livestock in the spring and early summer.[2/] It is also eaten by deer, elk, and antelope; birds and rodents are fond of its prolific seed. By late summer, however, the plant is dead and withered (figure 1), and herbage no longer palatable.

In 1962, on the Starkey Experimental Range near La Grande, Oregon, Jon Skovlin, Range Scientist, observed that the swelling at the base of the umbel, and occasionally the cauline stalks of biscuit-root, were inhabited by insect larvae. No ill effects on the plant were noted. Skovlin speculated that the typical swelling below the umbel (presumably a plant characteristic) might be related to the presence of the insects. Since many plant galls are caused by insects, the possibility was worth exploring.

In mid-August, 1962, a small collection of dead biscuit-root plants was forwarded to Forest Insect Research, Portland, for diagnosis. Sectioning the plant swellings revealed the presence of small fly maggots, about 1/8 inch long. These soon formed puparia (figure 2). A subsequent attempt to force-rear fly adults in fall was unsuccessful; however, the rearing disclosed that most of the fly puparia formed were parasitized. A few plants were held over the winter in an outside shed and in spring a few flies emerged, all with malformed wings and unsuitable for identification purposes. A field collection made in mid-May, 1963, produced nothing, indicating that spring emergence had already taken place.

On November 15, 1963, two large cardboard boxes of entire biscuit-root plants were collected from the Starkey Range and forwarded to Portland. The information gained by processing this material is the subject of this report.

1/ Irving, W. 1843. The Adventures of Captain Bonneville, U.S.A. Cooperative Publication Society, Inc. New York and London.

2/ Forest Service, U.S.D.A. 1937. Range plant handbook. Government Printing Office. (Re-printed 1966).

Figure 2. Longitudinal section of the swelling below the umbel showing a puparium of the pith-miner. (PS-3208)

OBJECTIVES

Examination of the biscuit-root plants was concerned with numbers and distribution of insects inside the stems, and with isolating insect specimens for rearing. In addition whole plants of biscuit-root were reared for insects. The objectives were to:

1. Obtain specimens of the pith-mining fly for specific identification.

2. Determine the relationship of the fly to the host plant, whether innocuous or damaging, including its possible role in gall-formation.

3. Determine the principal feeding sites of the fly within the host plant.

4. Assess the abundance of insect parasites, and other inhabitants of the biscuit-root stem.

METHODS

Upon receipt, the material collected in fall of 1963 was placed immediately in an outside shed. The following spring two steps were taken to analyze the material. First, during March 20-23, 50 stems, including the apical swelling, were slit longitudinally, and examined. Stem length ranged from 9 to 17 inches. The location of maggots, puparia, parasite larvae and groups of eggs along the inside of the stems was recorded. Insect specimens obtained were placed in small plastic boxes or in shell vials, with pieces of moist towelling, to obtain and observe emergence. Second, whole plants were clipped into upper and lower halves, with each group of halves placed in a glass-topped box with moist towelling, and held for insect emergence. Rearing of Lot 1, consisting of 40 plants, was initiated on April 1, and Lot 2, 60 plants, on April 15. In June, upon completion of the rearing, stems in Lot 2 were dissected to determine the proportion of insects successfully emerging. All rearings were in a basement laboratory room at a temperature of approximately 70°F.

RESULTS

Sectioning of Plants

Dissection of 50 stems showed evidence of feeding in the pith of either the stem or the apical swelling in 28 plants. All plants had apical swellings, regardless of presence or absence of feeding. Two distinct feeding sites were observed: (1) on the basal 6-inches of the stem, and (2) the area of the apical swelling, including the uppermost 1-2 inches of stem. A total of 18 puparia were found; 11 of these were in the swelling and 7 were in the lower part of the stem, 9 to 15 inches below the swelling. The findings are summarized below.

	Plants (number)
Pith undamaged	22
Pith fed upon, and containing:	
Puparia	18
Dead maggots	5
Parasite larvae	3
No insect specimens	2
Total	50

In contrast with material observed in 1962, the infestation in plants collected in fall of 1963 was light. Only 4 of the 28 infested plants showed more than one fly maggot to have fed within the plant.

Clusters of small soft upright yellow-orange eggs were found inside the pith of 18 of the stems examined. These eggs were unhatched at the time of examination, and none subsequently hatched. Of the stems having egg clusters, 13 showed no evidence of feeding. The insect depositing these eggs is unknown.

Nearly all puparia and parasite larvae isolated from this examination produced adults. Parasite larvae found in the pith had apparently issued from maggots; other parasites emerged from puparia as adults. In the limited sample obtained, parasite incidence was greater in the stems than in the swellings, 75 percent as compared with 50 percent.

Rearing of Plant Halves

In both lots, flies were recovered only from the upper halves of the plants, with 5 flies from Lot 1 (40 plants) and 16 flies from Lot 2 (60 plants). Parasites were reared from both the upper and lower halves of Lot 1, and only from the upper half of Lot 2. Parasite emergence commenced as the host emergence ended, and continued over approximately a 30-day period. Dissection of upper halves of stems from Lot 2 showed that all flies had emerged; three adult parasites had failed to find their way out of the stems. Rearing records are shown in Table 1.

Identification

From the fly adult (figure 3), the species was identified as Agromyza (Melanagromyza) n. sp., family Agromyzidae.[3/] The family includes several species of economic importance, attacking various crop plants; a large number of species mine the leaves of various plants. Parasites will be identified in the near future, now that host information is available to complete the labelling of specimens. All parasites were chalcidoid; one was recognized as a species of Eurytoma, another as a species of Habrocytus.

DISCUSSION

Two distinct feeding sites, one at the base and the other at the apex of the stem, were observed. Sectioning of stems showed a somewhat greater incidence of fly puparia in the apical area, specifically in the swelling, than in the lower stem. However, rearing by plant halves to obtain adults showed an even greater proportion of the flies in the upper half of the plant. The explanation appears to be differential survival between the two feeding sites, first during the period of maggot feeding and then later as parasitism exerts its effect. It is also likely that stoutness of the biscuit-root stem is a factor affecting either the site of egg deposition by the fly or survival of the maggots in the early stages. The stouter plants were selected for the longitudinal sectioning, in which a substantial proportion of the flies were found in the lower stem. The thinner plants were used for rearing by plant half, in which the large majority of the flies and parasites emerged from the upper half.

No damage appears to be caused by the fly to the biscuit-root plants, since the maggot feeds in the pith. One stem was noted to have broken about 4-5 inches above the ground, opposite a pith area with active feeding, but this could have occurred after the plant flowered and died. For the most part, the feeding by the fly probably is one of the biological events hastening deterioration of the dead stem and its gradual conversion into soil organic matter.

3/ Species determination by G. Steyskal, Branch of Insect Identification and Parasite Introduction Research, Agricultural Research Service.

Table 1. Emergence of Agromyza n. sp. and its parasites from entire plants of biscuit-root collected on the Starkey Experimental Range, November 15, 1963.

	LOT #1				LOT #2			
	Upper half		Lower half		Upper half		Lower half	
Period	Flies	Parasites	Flies	Parasites	Flies	Parasites	Flies	Parasites
April								
7-10	5	0	0	0	-	-	-	-
11-14	0	0	0	0	-	-	-	-
15-18	0	0	0	0	2	0	0	0
19-22	0	3	0	1	8	0	0	0
23-26	0	0	0	0	4	0	0	0
27-30	0	0	0	0	2	1	0	0
May								
1- 4	0	0	0	0	0	1	0	0
5- 8	0	0	0	0	0	2	0	0
9-12	0	1	0	0	0	1	0	0
13-16	0	0	0	0	0	1	0	0
17-20	0	0	0	0	0	0	0	0
21-24	0	1	0	1	0	0	0	0
TOTALS	5	5	0	2	16	6	0	0

Figure 3. Adult of the pith-miner, Agromyza n.sp. 19 X (PS-3209).

CONCLUSIONS

1. The fly, Agromyza (Melanagromyza) n. sp., has a symbiotic relationship with the biscuit-root plant, in which the insect inhabits and feeds on the pith without damage to its host.

2. The fly has two distinct feeding sites on the plant stem, one near the base and the other at the apex, but a large majority of the surviving population is found in the swellings at the apical part of the plant.

3. This innocuous species serves as a reservoir for several species of parasites, some of which undoubtedly attack various agromyzid species damaging range grasses.